Alg. 2 Warm Up # 2-3

1. Simplify:

a) $\dfrac{(3x)^{-2}}{y^3} \div \dfrac{x^5y^{-8}}{45}$

b) $(4x)^{1/2} \cdot x^{3/2}$

2. Solve:

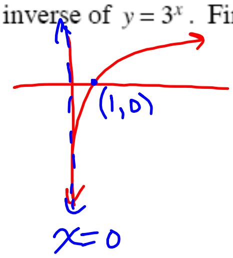
a) $4^{3x} = 4^{5x-8}$

b) $8^{2x+1} = \dfrac{1}{4}$

HW Questions:

Review & Preview

5-60. In problem 5-56, you looked at the inverse of $y = 3^x$. Finish investigating this function.



$x = 3^y$

y = the exponent on 3 that gives us x.

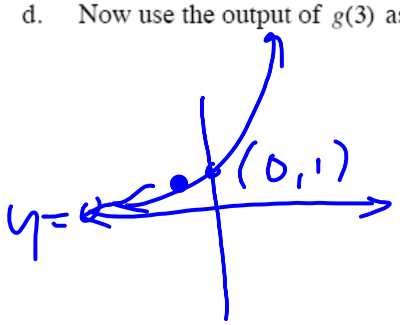
5-61. Consider the function $f(x) = \frac{2}{7-x}$.

a. What is $f(7)$?

b. What is the domain of $f(x)$?

c. If $g(x) = 2x + 5$, what is $g(3)$?

d. Now use the output of $g(3)$ as the input for f to calculate $f(g(3))$.



#60) x-int: (1,0)
vertical asymptote at x=0
dom: x>0
range: y=ℝ

5-62. Amanda wants to showcase her favorite function: $f(x) = 1 + \sqrt{x+5}$. She has built a function machine that performs these operations on the input values. Her brother Eric is always trying to mess up Amanda's stuff, so he created the inverse of $f(x)$, called it $e(x)$, and programmed it into a machine.

a. What is Eric's equation for his function $e(x)$?

b. What happens if the two machines are pushed together? What is $e(f(-4))$? Explain why this happens.

input

c. If $f(x)$ and $e(x)$ are graphed on the same set of axes, what would be true about the two graphs?

d. Draw the two graphs on the same set of axes. Be sure to show clearly the restricted domain and range of Amanda's function.

$f(x)$ input x	$e(x)$ input x
$+5$	-1
$\sqrt{\ }$	$(\ )^2$
$+1$	-5

a) $e(x) = (x-1)^2 - 5$

$e(f(-4)) = (f(-4) - 1)^2 - 5$

5-63. Sketch the graph of $y + 3 = 2^x$. $\rightarrow y = 2^x - 3$

a. What are the domain and range of this function? d: $x = \mathbb{R}$ r: $y > -3$

b. Does this function have a line of symmetry? If so, what is it? No

c. What are the x- and y-intercepts?

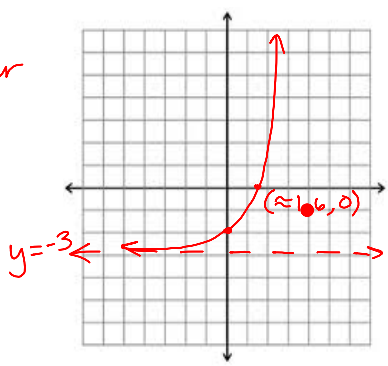
d. Change the equation so that the graph of the new equation has no x-intercepts.

Either reflect over the x-axis first:

$y = -2^x - 3$

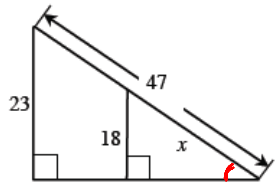
or move it up

$y = 2^x$

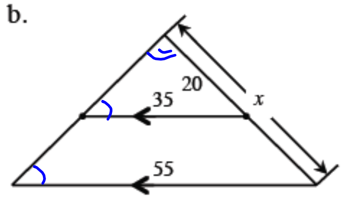


5-64. Solve for x in the following problems.

a.



b.



$$\frac{x}{47} = \frac{18}{23}$$

$$\frac{x}{20} = \frac{55}{35}$$

5-65. A woman plans to invest x dollars. Her investment counselor advises her that a safe plan is to invest 30% of that money in bonds and 70% in low risk stocks. The bonds currently have a simple interest rate of 7% and the stock has a dividend rate (like simple interest) of 9%.

a. Write an expression for the annual income that will come from the bond investment.

Let B = amount of \$ earned in Bonds → $B = (0.30x)(0.07)$

$B = 0.021x$

b. Write an expression for the annual income that will come from the stock investment.

S = amount of \$ earned in Stocks → $S = (0.70x)(0.09)$

$S = 0.063x$

c. Write an equation and solve it to find out how much the client needs to invest to have an annual income of \$5,000.

$B + S = 5{,}000$

$0.021x + 0.063x = 5{,}000$

5-66. Factor each expression completely.

a. $x^2 - 49$ b. $6x^2 + 48x$ c. $x^2 - x - 72$ d. $2x^3 - 8x$

$2x(x^2 - 4)$

$2x(x+2)(x-2)$

5-67. Sketch the solution to this system of inequalities.

parabola
left 5, down 6
No stretch or
compression:

$y \geq (x+5)^2 - 6$

$y \leq -(x+4)^2 - 1$

reflect over x-axis
left 4, down 1

Yesterday's Pink CP's:

5-56. THE INVERSE EXPONENTIAL FUNCTION

There are two parent functions, $y = |x|$ and $y = b^x$, that have inverses that you do not yet know how to write in y = form. You will come back to $y = |x|$ later. Since exponential functions are so useful for modeling situations in the world, the inverse of an exponential function is also important. Use $y = 3^x$ as an example. Even though you may not know how to write the inverse of $y = 3^x$ in y = form, you already know a lot about it.

a. You know how to make an $x \to y$ table for the inverse of $y = 3^x$. Make the table.

b. You also know what the graph of the inverse looks like. Sketch the graph.

c. You also have one way to write the equation based on your algebraic shortcut that you used in part (d) of problem 5-40. Write an equation for the inverse, even though it may not be in y = form.

$\boxed{x = 3^y}$

d. If the input for the inverse function is 81, what is the output? If you could write an equation for this function in y = form, or as a function $g(x) =$, and you put in any number for x, how would you describe the outcome?

$81 = 3^y$

$g(x)$ = an exponent on the base 3 that gives me x.

5-57. AN ANCIENT PUZZLE

Parts (a) through (f) below are similar to a puzzle that is more than 2100 years old. Mathematicians first created the puzzle in ancient India in the 2nd century BC. More recently, about 700 years ago, Muslim mathematicians created the first tables allowing them to find answers to this type of puzzle quickly. Tables similar to them appeared in school math books until recently.

Here are some clues to help you figure out how the puzzle works: 3

$2^3 = 8$ ← $\log_2 8 = 3$ exp. base — $\log_3 27 = 3$ — $3^3 = 27$

$5^2 = 25$ ← $\log_5 25 = 2$ — $\log_{10} 10{,}000 = 4$ — $10^4 = 10{,}000$

Use the clues to find the missing pieces of the puzzles below:

a. $\log_2 16 = ?$ 4 — b. $\log_2 32 = ?$ — c. $\log_? 100 = 2$

d. $\log_5 ? = 3$ — e. $\log_? 81 = 4$ — f. $\log_{100} 10 = ?$

125 — 3

5-58. How is the Ancient Puzzle related to the problem of the inverse function for $y = 3^x$ in problem 5-56? Show how you can use the idea in the Ancient Puzzle to write an equation in $y =$ form or as $g(x) =$ for the inverse function in problem 5-56.

$x = 3^y$ → $y =$ exponent on base 3 that $= x$

same

$$\boxed{y = \log_3 x}$$

CP's: 5- #68 ---> 70 (blue revised)

5.2.2 What is a logarithm?

Defining the Inverse of an Exponential Function

You have learned how to "undo" many different functions. However, the exponential function has posed some difficulty. In this lesson, you will learn more about the inverse exponential function. In particular, you will learn how to write an inverse exponential function in y = form.

Alg 2B CP's: 5 - #68 → 71 (Revised) Name ______

$\boxed{5-68}$ Fill in the outcomes for the table. Think about what the outcomes, $g(x)$, represent.

x	$g(x)$
8	3
32	5
$\frac{1}{2}$	-1
1	0
16	4
4	2
3	≈ 1.59
64	6
2	1
0	undef.
0.25	-2
-1	undef.
$\sqrt{2}$	$\frac{1}{2}$
0.2	≈ -2.32
$\frac{1}{8}$	-3

Start by noticing the relationship between the numbers given. Describe, in words, the relationship between x and $g(x)$. Write an equation for $g(x)$.

→ $g(x)$ is the exponent on the base 2 to get x.

Show your thinking here to find outcomes for:

$x = 3$ (Nearest hundredth) $x = 0.2$

Why is it difficult to find outcomes for $x = 0$ and $x = -1$?

Show your thinking here to find an outcome for $x = 25$.

$< 25 <$

$2 < 2^{?} < 2$

$\boxed{5\text{-}69}$ $g(x) = \log_5 x$

x	$g(x)$
$\frac{1}{25}$	
$\frac{1}{5}$	
1	
5	
25	
125	
625	
2	
3	

a) Fill in the outcomes you know from base 5.

b) Find outcomes for $x=2$ & $x=3$ (Nearest hundredth)

$\boxed{x=2}$

$x \rightarrow 1 < 2 < 5$

$5^0 < 5^{g(2)} < 5^1$

$g(2)$ is between 0 and 1

Show thinking here:

$g(2) \approx$ __________

$\boxed{x=3}$

$x \rightarrow 1 < 3 < 5$

$5^0 < 5^? < 5^1$

Show the rest of your thinking:

$g(3) \approx$ __________

$\boxed{5\text{-}69 \text{ cont'}}$ b) Think about relationships between 2, 4, and 8.

How can you express 4 and 8 using exponent rules with base 2?

$2^{\square} = 4$

$2^{\square} = 8$

From your estimation, $2 \approx 5^{\square}$

How can we use that to get $g(4)$ & $g(8)$?

Using exponent rules to fill in the rest of the table: (nearest hundredth

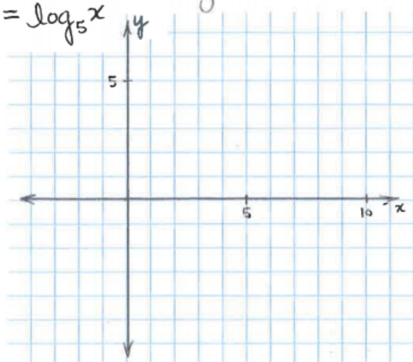
$(a^m)^n = a^{mn}$ $\qquad a^m \cdot a^n = a^{m+n}$

x	$g(x)$
4	
8	
6	
10	
100	
$\frac{1}{2}$	

- for $x = 6$ → think about the relationship with 2 & 3
  show your thinking here:

- estimate $g(10)$, $g(100)$ and $g(\frac{1}{2})$ showing your thinking:

Use the values from your tables to carefully sketch the graph of $g(x) = \log_5 x$



Draw the vertical asymptote with a dashed line.

What relationship does your graph of $g(x) = \log_5 x$ have with the graph of $y = 5^x$?

$\boxed{5\text{-}70}$ Change from log form to equivalent exponent form:

a) $\log_2 32 =$ ____ Exponent form → ____________

b) $\log_2 (\frac{1}{2}) =$ ____ ____________

c) $\log_2 4 =$ ____ ____________

d) $\log_2 16 =$ ____ ____________

e) $\log_2 8 =$ ____ ____________

Change from exponent form to equivalent log form:

f) $2^{1/2} =$ ____ Log Form $\longrightarrow$ ____________

g) $2^{-4} =$ ____ ____________

h) $2^{0} =$ ____ ____________

i) $2^{1/3} =$ ____ ____________

j) $2^{-3} =$ ____ ____________

$\boxed{5-71}$ Find the inverse. Start by switching the x and y, then get y by itself by switching forms and/or using some Algebra. Think about what order you should do that.

a) $y = \log_9 x$ b) $y = \log_6(x+1)$ c) $y = 5^{2x}$

HW: 5 -

* Do Classwork through # 69

73 ---> 80

Short Quiz tomorrow:
Write a system of Inequalities from a graph.
Simplify exponents.